

## **Station Briefing Papers**

**Science-Based Solutions for the Four Threats  
to the Health of the Nation's Forests and Grasslands**

**Northeastern Research Station**

USDA Forest Service



**Research and  
Development**

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## **FIRE AND FUELS**

### **Current Emphasis**

- ✓ Studying fire both as a destructive force that harms forests and as a useful tool for promoting healthy conditions in forests.
- ✓ Investigating the effects of fire on trees and other vegetation, wildlife, pests, and watershed properties.
- ✓ Studying fragmentation in forested ecosystems and techniques for monitoring the health of urban forests.

### **Research Results**

- ✓ Refined the National Fire Danger Rating System to fit the unique ecosystem of New Jersey's Pine Barrens.
- ✓ Fine fuels are more abundant in forest stands that have been invaded by non-native plants.
- ✓ Fire is important in sustaining oak forests. Methods to reduce vegetation that competes with oak seedlings using fire are available.
- ✓ More bats and birds forage on flying insects in thinned mixed-oak forests than in closed-canopy forests.
- ✓ Prescribed fire can be used for fuel reduction and ecological restoration of central hardwoods without unacceptable fire injury.

### **Further Research**

- ✓ Define the characteristics of the Eastern forest that make it vulnerable to catastrophic wildfires in the wildland-urban interface.
- ✓ Characterize and predict urban sprawl and its effects on the wooded countryside

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## INVASIVE SPECIES

### Current Emphasis

- ✓ Improving knowledge of Asian longhorned beetle (ALB) biology
- ✓ Improving knowledge of hemlock wooly adelgid (HWA) biology and its interactions with other pests. HWA is the single greatest threat to the health and sustainability of hemlock as a forest resource in the Northeast.
- ✓ Developing methods for mass-rearing ALB in quarantine.
- ✓ Developing management technologies for ALB, including environmentally safe biological controls.
- ✓ Establishing colonies for two species of Chinese lady beetles as a cost effective biocontrol of HWA.
- ✓ Developing methods for recognizing the susceptibility of individual trees and vulnerability of stands to invasive species attack.
- ✓ Devising improved methods for surveying populations and damage, and for predicting the impact and spatial and temporal movement of insects
- ✓ Developing a knowledge base for restoration of damaged stands.
- ✓ Developing superior beech trees for planting and restoration that are resistant to beech bark disease (BBD).
- ✓ Refining new production methods for Gypchek for cost-effective control of the gypsy moth.

### Research Results

- ✓ ALB threatens \$700 billion in trees located in urban areas alone; industries such as maple sugar, lumber, nursery, commercial fruit, and fall-foliage tourism could incur \$650 billion in losses.
- ✓ ALB breeds in American tree species at twice the rate it breeds in its native China.
- ✓ Parasitic worms known as nematodes invade ALB larvae and are environmentally safe alternatives to chemical pesticides.
- ✓ Ability to identify origin of ALB in US forests through DNA markers will result in new biological control.
- ✓ Flight patterns of ALB can help predict: (1) how far the beetle disperses and (2) the mechanisms that trigger flight. More than 85 percent of males and half of females fly in search of a mate or a tree to feed on.
- ✓ At least one of the *Bacillus thuringiensis* (Bt) toxins being tested against ALB is toxic to adult beetles.

- ✓ Accidental introduction of the nun moth would be catastrophic because it survives on 11 northeastern conifers and 12 hardwood species.
- ✓ A new strain of the Gypchek viral pesticide was developed for control of the gypsy moth; this new strain is less labor intensive and less costly to produce. Gypchek was developed and patented by NE.
- ✓ Assessing the effects two species of protozoan pathogens (microsporidia) from the Slovak Republic for controlling gypsy moth and other moths and butterflies in North America.
- ✓ Assessing two species of predatory lady beetles from China for reducing populations of HWA.
- ✓ Eradication of invasive species can be achieved without eliminating the total population. When populations are reduced below a critical level, they proceed to become extinct in U.S. forest ecosystems without further intervention.
- ✓ Satellite imaging of forests is as effective as ground-level tests in predicting and monitoring the spread of invasive insects.
- ✓ Identifying American beech trees resistant to beech bark disease (BBD). This disease results from heavy infestation with a scale insect on the bark, rendering the tree susceptible to a fungus.
- ✓ Developing strains of disease-resistant elms to be planted in the first hardwood species restoration project in the United States.

## **Further Research**

### **Asian Longhorned Beetle**

- ✓ Identify the predators that can be introduced to control ALB.
- ✓ Use of insecticides to control ALB is expensive and problematic for urban areas (biological control currently is the only management tool against ALB).
- ✓ Develop techniques for rapid and reliable detection of ALB.
- ✓ Role of increased trade with trade with China in elevating the risk of further spread of ALB into North America.
- ✓ Determine the extent of damage if ALB expands beyond the current quarantined areas.
- ✓ Determine the levels of tree mortality and decline to be expected in infested areas.
- ✓ Determine the effects on forests and forest ecosystems, including watershed and wildlife habitat of trees destroyed by ALB.

### **Hemlock Woolly Adelgid**

- ✓ Discover native enemies to keep HWA population in balance.
- ✓ Improve detection of low-level HWA populations.
- ✓ Improve survey and monitoring methods.
- ✓ Find alternatives to insecticides for controlling HWA, which are expensive and limited to accessible areas.
- ✓ Refine and implement management tools and strategies.

### **Nun Moth**

- ✓ Improve understanding of the biology of the nun moth.
- ✓ Develop effective ways to educate public/professionals to identify the presence of nun moth.
- ✓ Establish nun moth colonies in quarantine to study and develop biological controls and management technologies.

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## **LOSS OF OPEN SPACE**

### **Current Emphasis**

- ✓ Studying habitat loss, natural history, and distribution of various species of wildlife.
- ✓ Monitoring forest health trends in urbanizing areas.
- ✓ Assessing the effectiveness of “best management practices” for protecting water quality, hydrology, and fauna in seasonal forest ponds in urban areas.
- ✓ Inventorying the urban-forest resource, learning how urbanization affects local forest stands, and assisting city officials in urban forest planning.
- ✓ Determining the effects of urban forest on air and water quality, building energy use, urban climate, ultraviolet radiation, and related factors.
- ✓ Leading comprehensive studies of urban ecosystem (e.g., the Long Term Ecosystem Research project in Baltimore, MD).
- ✓ Developing more accurate Landsat-based tree and impervious cover maps (30-meter resolution) to assess urban tree cover at all scales.

### **Research Results**

- ✓ Whitetail deer in fragmented exurban landscapes are jeopardizing the sustainability of eastern forests by reducing the number of tree species, slowing regeneration rates, eliminating habitat for wildlife, and threatening forest biodiversity.

- ✓ For the first time in the history of the forest inventory, there is downward trend in the size of forestland in the Northeastern States as urban sprawl continues to outpace regeneration.
- ✓ Forest biodiversity is declining as trees mature and young stands are becoming scarce. Red maple is increasing its dominance in eastern hardwood forests.
- ✓ Rapid changes in land use over much of New England have resulted in the loss of wildlife habitats and consequent decline in biodiversity.
- ✓ Gained new information about the habitat associations for terrestrial salamanders in managed New England northern hardwood stands.
- ✓ Knowledge of fauna in freshwater ponds and the effects of urbanization in the surrounding forest on pond sediment and water chemistry.
- ✓ Changing landscapes from non-urban to urban land use can significantly increase carbon levels in soils, thereby influencing concentrations of greenhouse gases.
- ✓ Urban forests store more greenhouse gases than non-urban trees.
- ✓ Exposure to ultraviolet radiation is twice as great among children who live in apartments than among children who live in single-family homes.
- ✓ Predict and analyze the effect of new patterns of development on the urban environment.
- ✓ Use native plants to attract birds and other wildlife for maintaining biodiversity.
- ✓ Provide access to sensitive plot data in urbanizing areas without compromising the integrity of the plot.
- ✓ Gain more knowledge about the needs and concerns of private woodland owners across the United States, including motivations for management and parcelization decisions.
- ✓ Develop land-stewardship software to help owners create stewardship plans that qualify for tax abatement and/or state cost-share programs.
- ✓ Measure the size of forested area in densely populated area of the Northeast and the influences of occupation on the condition of the forest.
- ✓ Protect citizens and their property in the wildland-urban interface.

### **Further Research**

- ✓ Measure losses in biodiversity due to urban sprawl and fragmentation.
- ✓ Effects of rapid changes in land use on wildlife and the regeneration of desirable tree species.
- ✓ Influence of farmland development on species that use fields and thickets.

- ✓ Determine minimum requirements for breeding and living space of wildlife in areas that are being fragmented.
- ✓ Effects of urban trees on the city and overall well-being of its citizens.
- ✓ Identify the pathways for the introduction foreign pests, diseases, and invasive plants through urbanization.
- ✓ Extent of loss of ecological integrity in non-forestlands for traditional forest values.

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## UNMANAGED RECREATION

### Current Emphasis

- ✓ Investigating the integration of social and biophysical sciences for natural resource management.
- ✓ Studying uses for wild plants and developing community-based strategies for sustainable management due to the changing land ownership in the Yucatan Peninsula.

### Research Results

- ✓ User fees influence the satisfaction of recreation experiences in public forests. Even small fees can cause them to recreate elsewhere.
- ✓ Most people in the Northeast prefer moderate amounts of timber harvesting, snowmobile access on public lands, and lower levels of off-road vehicle use.
- ✓ Many plants and fungi are used by people in and near the forest to supplement their livelihoods. In many rural communities, gathering non-timber forest products such as berries, mushrooms, and evergreen boughs, makes a major difference in the health and economy of the population.

### Further Research

Design more studies to learn people's attitudes toward recreational land use, such as highway vehicles.